CASE STUDY – CITY OF ATLANTA DEPARTMENT OF WATERSHED MANAGEMENT

a. Category – Application of Practice of Understanding the Condition of Buried Assets

b. Executive Summary

The City of Atlanta, located in the northern part of Georgia, has a sewer system with parts of the system dating back to the mid-1860s. Combined Sewer Overflows (CSOs) and Separate Sewer Overflows (SSOs) consent decrees required the City to make aggressive progress in addressing rehabilitation and repair of the sewer system. As part of the overall management and implementation of the consent decree, the City of Atlanta embraced an asset management philosophy.

To date, the City has spent approximately $900 million on collection system improvements, including sewer separation, gunnite improvements, and more than 250 miles of rehabilitation. A total of $2 billion to 2.5 billion will be spent for the entire Sanitary Sewer Evaluation Survey (SSES), as well as rehabilitation and capacity relief projects. The SSES cost is $130 million, or approximately 5% of the entire investment.

Early on in the program, the City looked at spills and found that they were occurring so randomly that inspecting the entire collection system would be necessary. The program has focused on three components: the Sanitary Sewer Evaluation Study (SSES) and rehabilitation selection process, completely updating the Geographic Information System (GIS), and constructing a hydraulic model.

City collection system maintenance crews clean and maintain the system. Fully 25% of the entire system is being cleaned every year, but it is focused in specific areas that have the greatest need, rather than being rotated throughout the City. The cleaning program is closely integrated with the City’s Grease Management Program.

During the past five years, Atlanta’s water and sewer rates have increased dramatically to support these compliance programs. However, a 1 cent sales tax was approved that also generates revenue for the system and reduces the amount paid by customers. This has required strong leadership which the City has had under Mayor Franklin.

c. Introduction

The City of Atlanta is located in the northern part of the state of Georgia. The City’s motto is “Resurgens,” which is Latin for “Rising Again.” It reflects the City’s resurgence as the economic center of the “New South.” The City is the hub of north Georgia’s explosive growth, home to the world’s busiest commercial airport, and location of the 1996 summer Olympic Games.
The City’s sewer system was an entity of the general fund for 85 years, and was moved into an enterprise fund in the mid-1960s that provided the system with dedicated funding. Some of the City’s infrastructure dates from Atlanta’s first period of rapid growth in the 1860s. The age of Atlanta’s infrastructure and extensive combined sewer system along with a hilly topography and upstream location in the sensitive Chattahoochee River watershed has meant that the City faces unique challenges. The City is the “poster child” for Combined Sewer Overflows (CSOs) and Separate Sewer Overflows (SSOs) consent decrees.

CSO and SSO Consent Decrees Require Compliance

The Clean Water Act passed in 1972 prohibits unpermitted discharges of wastewater to receiving waters of the United States. Combined sewers, such as those in Atlanta, were originally designed and constructed prior to 1972 to overflow into receiving waters during periods of heavier rainfall.

The City of Atlanta entered into a consent decree with the U.S. Environmental Protection Agency and the Georgia Environmental Protection Division to reduce or eliminate CSOs. A consent decree is a legal document that is signed by both the community and an enforcement agency that binds the community to complete specific activities that will lead to the elimination or reduction of sewer overflows in their municipal sewer system. For the City of Atlanta’s CSO consent decree, the compliance period was 1998 to 2008. The CSO remedial actions included: evaluation programs; approximately $1 billion in capital improvements to the wastewater system; management, operations and maintenance programs, and supplemental environmental programs such as the acquisition of greenways.

The City also has an SSO consent decree. SSOs may occur when there is a constriction in the sewer, such as a blockage of tree roots, grease, or sewer collapse. SSOs also may occur due to insufficient capacity or infiltration or inflow of rainwater. The City’s compliance period for the SSO consent decree is 1999 to 2014. The SSO remedial actions include: management, operations and maintenance programs; $1.7 billion in capital improvements; and evaluation, rehabilitation and capacity relief in the collection and transmission systems.

d. Background Information

Development of a Plan

In 2002, Atlanta’s newly elected Mayor Shirley Franklin unveiled a five-point plan in response to the requirements of both consent decrees. The plan, which became known as the Clean Water Atlanta Program, focused on:

- professional management of the consent decrees.
- compliance with SSO consent decree.
• compliance with the CSO consent decree.

• water quality monitoring.

The Mayor formed the Department of Watershed Management (DWM) in September 2002, which includes drinking water, wastewater, and stormwater management functions. The annual operating budget is $468 million, and the 10-year Capital Improvement Program is $3.9 billion. The DWM has more than 1,800 authorized full-time positions. While the City of Atlanta includes only one-tenth of the five million plus population of metro Atlanta, Atlanta is a regional service provider. The City provides treated water to more than 1 million people in a 650 square mile area, and wastewater treatment for 1.2 million. The system comprises 1,900 miles of sewers (300 miles of which are combined), three wastewater plants with an average daily flow of 220 million gallons per day, and 16 pump stations. In addition, within the City, lateral sewers from the right-of-way to the main line comprise 284 miles.

As part of the overall management and implementation of the consent decree, the City of Atlanta embraced an asset management philosophy. Atlanta did not have the tools to make the case for asset management in previous years. The City did not have analytical capabilities it needed, such as IT tools, which are critical to make strategic asset management decisions.

e. Description of Best Practices including Personnel/Departments (Institutions) Involved

**Timetable for Improvements**

To date, the City has spent approximately $900 million on collection system improvements, including sewer separation, gunnite improvements, and more than 250 miles of rehabilitation. A total of $2 billion to 2.5 billion will be spent for the entire Sanitary Sewer Evaluation Survey (SSES), as well as rehabilitation and capacity relief projects. The SSES cost is $130 million, or approximately 5% of the entire investment.

The City has an aggressive program to complete sewer rehabilitation in advance of consent decree deadlines.

<table>
<thead>
<tr>
<th>Sewer Group</th>
<th>Planned Miles of Rehabilitation</th>
<th>Scheduled Completion</th>
<th>Compliance Deadline</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>145</td>
<td>12/31/08</td>
<td>07/1/09</td>
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<td>2</td>
<td>165</td>
<td>06/30/10</td>
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The First Amended SSO Consent Decree (FACD) originally negotiated a staggered schedule for completion of the six collection system Sewer Groups. A sewershed ranges between 10 to 50,000 linear feet of mainline sewer with an average of 33,500 feet. There are 40 to 50 sewersheds per Sewer Group. A separate schedule for analysis and implementation of capacity relief independent from sewer rehabilitation has been established in order to deal with parts of the system with capacity constraints. Now, every Sewer Group always has evaluation, rehabilitation, and maintenance work going on in order to spread the benefits from this work throughout the City.

**Planning the Program**

Early on in the program, the City looked at spills and found that they were occurring so randomly that inspecting the entire collection system would be necessary. The collection system maintenance staff identified problematic areas throughout system in several work sessions. Subsequently, the prioritization of the Sewer Groups took into account the following criteria:

- Frequency of overflows.
- Severity of Rainfall Derived Infiltration and Inflow (RDI/I)
- Risk to surface waters (creeks).
- Impact of failure.
- Status of any ongoing rehabilitation or renewal.
- Available capacity of sewers.
- Judgment of Sewer Operation and Maintenance Division.
- Relative Impact of RDI/I from jurisdictions outside the City’s control.
- Proposed development intensity.
• Location of sewer within the combined system.

Sewer Group boundaries were adjusted in order to deal with identified problems, especially upstream issues, in order to take a true “system” perspective.

**Components of the Plan**

The program has focused on three components: the Sanitary Sewer Evaluation Study (SSES) and rehabilitation selection process, completely updating the Geographic Information System (GIS), and constructing a hydraulic model. Data from the SSES is synthesized through an in-depth QA/QC process. It is then uploaded to the GIS hub, following which the Hydraulic Modeling Group performs analysis in support of the rehabilitation selection process.

**SSES**

To establish credibility with the regulator, the City felt it had to inspect the entire system. The SSES is focused on establishing a comprehensive and accurate inventory of the system, and developing data to make decisions. The system is inspected for overall condition, and sources of inflow and infiltration to the system are identified. Cost effective rehabilitation solutions are developed and incorporated into capacity upgrades where necessary within the rehabilitation proposals.

Work has been prioritized throughout the six sewer groups such that the areas that are believed to be in the worst condition are evaluation first. SSES inspection activities include: closed circuit televising (CCTV); manhole inspections, including GPS location; smoke and dye testing of the lateral; building plumbing location and inspection; and flow isolation, service lateral inspection and temporary flow monitoring, as appropriate.

The City uses up to four contractors under a detailed specification to perform the SSES work. Each contractor must follow a well-defined data/report protocol Primavera Expedition is used for submittals and payment processing. The typical field inspection cycle includes manhole data collection and verification of connectivity, manual and digital CCTV data review, and then merging and uploading data to GIS.

**GIS**

The City has implemented an enterprise-wide GIS. GIS information can be accessed via the Internet using web-based tools and ESRI’s ArcIMS (Internet Mapping Service), ArcGIS Server, an Oracle database and ESRI’s Spatial Database Engine. As part of this project, CAD-based drawings had to be converted to a geodatabase format.

The GIS provides many benefits. For example, the City has placed great emphasis on capacity management, taking RDI/I out of the system. Many areas of the city are capacity limited, so the City has focused on large diameter main lines with larger carrying capacity believing that they provide the biggest benefit. The City has given special attention to
trunk sewers which have been constructed in flood plains and combined sewers in major creeks, which are often under water tables. In precipitation events with stream levels rising, trunk sewers are essentially draining the surface water when certain conditions exist.

In Atlanta, if engineering analysis determines that a sewer basin has a capacity limitation, from that point forward, new wastewater flow is not allowed to enter the system until additional capacity is achieved by the City. The FACD allows new flows but measures must be taken to insure that the new flow will not make conditions worse. This means that new flows can be allowed to enter the collection system but only after the City has eliminated RDI/I through a “find and fix” process. At first, five gallons would have to be removed for every one gallon allowed into the system. Currently three gallons have to be removed for every gallon allowed. Due to the RDI/I reductions and credits gained, the City can continue to develop and add capacity and has been able to approve about 15,000 capacity permits.

The GIS develops automated RDI/I credit reports by sewershed that are created from calculations from CCTV condition information and completed rehabilitation. The capacity credit system requirement does not exist when sufficient permanent capacity is in place.

Another benefit of the GIS is traffic coordination. Traffic coordination is managed through a GIS interface with the Work Order Management System to deliver public information about projects in the right-of-way that may disrupt traffic. Also, the City has developed real-time mobile applications.

**Hydraulic Modeling**

The GIS links to the Hydraulic Model. For the Hydraulic Model, the City has a macro model of the system for sewers that are 12 inches in diameter and larger. This system model is always being updated. In addition, a series of micro models are built to evaluate structural and service defects identified in the SSES work.

Using the results of the SSES and hydraulic models, the City makes decisions on where capacity is needed and structural rehabilitation. The overriding goal is system reliability and elimination of overflows. The City is trying to identify where they can most cost effectively rehabilitate.

Rehabilitation contracts are defined in two categories. “Defined contracts”, comprising 75% of the value of the work, are used to implement the designs of the Program Management Team (PMT). “Undefined contracts” have rehabilitation method specificity only and do not include design. They are used to correct problems that must be fixed immediately and comprise the remaining 25%.

The PMT developed a Rehabilitation Selection Tool (RST), which is a web-based application that uses SSES and GIS data to help make decisions about rehabilitation technology to be used and the associated costs. The RST helps guide the selection
process but does not replace engineering judgment in the process. The RST helps the City make efficient, timely decisions.

City staff and contractors use the NASSCO Pipeline Assessment Condition Protocol grade system for categorizing sewer conditions based on the internal condition determined during the CCTV inspection process. If the City identifies a sewer segment with an Internal Condition Grade (ICG) of 5 (worst condition indicating actual or imminent collapse), the contractor takes immediate action under the Undefined Contract. This activity includes point repairs of potential cave-ins. Parts of the system with Internal Condition Grades of 4 and 5 form the bulk of the rehabilitation work and are typically where structural and service defects are identified. Rehabilitation may include pipe bursting, if capacity management indicates the need for capacity relief in trunk lines.

The SSES Team works in close coordination with Modeling Team. The Modeling Team takes the SSES data, and uses it to update, change and refine the hydraulic model. Extensive triage and interaction are used by different teams. The intent is to move into more structured, formal decision-making over time. However, the overarching finding and big lesson learned from SSES is that doing the cleaning and CCTV have helped Atlanta get to know the system and generate data to make decisions. Data is revised and acted upon in accordance with the flow chart shown in Figure 1.
Early on, City contractors were inspecting both main lines and laterals through CCTV. While all major camera vendors say that they can inspect the lateral from the main line by launching spirals, this technology did not have the results that the City needed.
City has a program to put clean-outs at the demarcation point between public and private parts of the lateral.

CCTV tools are used to analyze past and current shots of the sewer system. Eighty percent of Atlanta’s system is small diameter line under 18 inches. The assessment of these lines is only structural. For those ICGs rating 4 and 5, the City rehabilitates the lines. Everything else is deferred until 2014, after the consent decree period. Trunk sewers are treated differently, as capacity relief and RDI/I drive the decisions.

During the consent decree period, the City anticipates rehabilitating 30% of the entire system (similar to the results seen in Sewer Group 1).

Other Initiatives

The program has focused on three components: the Sanitary Sewer Evaluation Study (SSES) and rehabilitation selection process, completely updating the Geographic Information System (GIS), and constructing a hydraulic model. Data from the SSES is synthesized through an in-depth QA/QC process. It is then uploaded to the GIS hub, following which the Hydraulic Modeling Group performs analysis in support of the rehabilitation selection process.

The City contractors that are CCTVing the system do an initial cleaning that is sufficient to support CCTV inspection. City collection system maintenance crews clean and maintain the system. Fully 25% of the entire system is being cleaned every year, but it is focused in specific areas that have the greatest need, rather than being rotated throughout the City.

The cleaning program is closely integrated with the City’s Grease Management Program. Since 70% of spills were blockage related, and the majority of the blockages were grease related, the City now issues annual permits to all food service establishments and inspects grease traps three times per year. This level of inspection for grease traps represents an increase of two times that specified in the consent decree because the City found a better result was obtained with three inspections.

The City has reduced spills from 1,000 to 300 per year since 1999 due to rehabilitation, capacity relief, and increased O&M for blockages.

Interim Results

Some interesting findings and lessons learned have emerged during the initial phases of the City’s program:

- Of approximately 40,000 manholes in the system, 1,400 manholes or 4%, were buried and had to be raised.
• Where development is less dense, there are typically more trees and as a result, more root issues. Vandalism is another significant contribution to blockages.

• Sewer Groups 5 and 6 are the combined sewer areas which require the greatest amount of work and will be done last.

• Only a very few miles of force mains have been inspected to date, given the challenge of inspecting these lines.

• A significant benefit to the system going forward is the requirement that new development must reduce runoff peak by 30% for stormwater runoff. Wastewater flows for the newer developments are a much smaller issue.

• The City also has a very significant water main replacement program, with its own system of prioritizing replacements. The City coordinates sewer, water and gas work to coordinate and less the impacts on the neighborhood, and paving after all the work has been completed.

Program Funding

During the past five years, Atlanta’s water and sewer rates have increased dramatically to support these compliance programs. However, a 1 cent sales tax was approved that also generates revenue for the system and reduces the amount paid by customers. This has required strong leadership which the City has had under Mayor Franklin. The Mayor is a former Chief Operating Officer and bureau director under former mayors Maynard and Jackson. She has been open and transparent, and very direct in reaching out to the public, making clean water the focus of her tenure. She realizes that enforcement of the consent decree would shut down the City. To keep it going, she has to have the necessary revenue, including a long-term financial plan with continued rate increases. The business community is behind the Mayor, and the financial plan because without investing in the water and sewer system, they recognize that the City would be shut down.

The average water and sewer bill is $65/month. The City does not tell customers how they compare to other water utilities in other part of the country, but rather how the bill compares to other utilities such as electricity and gas.

The City can see that water conservation is happening as a result of a tiered rate structure with increasing rates. The City has some affordability programs for elderly customers.

f. Summary of Key Lessons and Experiences (Results and Findings)

1. It is all about data (text, images, etc.). The City now has 13 terabytes of information on its system. Data is a key element of any strategic asset management program.
2. Link the GIS to a hydraulic model to facilitate decision-making.

3. Drive down the cost of construction with contractors used in strategic ways to optimize decision-making and results.

4. Conduct collection systems operations and maintenance activities on a regular, strategic and predictive basis.

5. Engage the support of the public to make the necessary investments.

Further details on the City of Atlanta’s programs can be obtained from the following papers presented at the Pipelines 2007 conference of the American Society of Civil Engineers:

Hunter, R.J. and Sukenik, W.H.  Atlanta’s Consent Decrees Drive a Substantial Commitment to Trenchless Sewer Rehabilitation

Hutchinson, R.El. El-Sayegh, H.K., and Chambers, L.  Atlanta’s SSES & Integrated Sewer Rehabilitation Selection Process

Brown, C. and Toomer, K.  Clean Water Atlanta Enterprise GIS

Bechara, A., Brewer, B., Clark, L., and Iaukea, K.  Hydraulic Modeling – A Tool for Addressing the Consent Decree